

# Preface

During the last decade, a lot of attention has been paid to innovation systems at different levels, but there remains little consensus in the literature about which components such a national innovation system should contain. Existing approaches to national innovation systems are predominantly based on the experiences of countries marked by high income levels, a broad knowledge base, lengthy experience of a market economy, well-functioning markets, developed and stable institutional frameworks, and advanced infrastructures for supporting innovation.

In the majority of the new EU Member States the situation is very different. They have recently gone through the systemic change from a command economy to a market economy, their income levels are considerably lower, knowledge base narrower, infrastructure weaker, and their institutional frameworks for innovation support are still emerging. Thus, in comparison to well-developed economies, these countries are at a different stage along the development path. Due to these differences, the national innovation systems developed elsewhere cannot be applied in these countries.

Research into innovation systems has to a great extent focused on large economies, while several of the new EU Member States are relatively small in terms of population and GDP. Thus, it is important to study how these countries could overcome the problems caused by their smallness – which is a serious disadvantage from the perspective of market attractiveness or in terms of resource endowments – and succeed in using their latecomer advantages. For example, developing human capital and executing the institutional changes are necessary for adapting new Western technologies. This should be studied not only at the country level but also at the company level.

The studies of national innovation systems provide the most meaningful results in the comparative perspective. Therefore, it is more beneficial to study several countries rather than a single country. The wider view of national innovation systems suggests that in addition to studying research organizations and institutions closely related to the creation of new knowledge, it is also important to examine how the innovation system is linked to the economic system and the community. For example, the links to production and the system for financing should be investigated. The knowledge generation processes, related support services (financing, labor, education),

and potential changes the new knowledge induces in all spheres of the community are also elements of this wider view.

The combination of innovation system, smallness, and catching-up latecomer status is an important issue, especially in, but not limited to, the context of the enlarged EU. These countries have an economic impact on larger countries and their experience could be useful for other catching-up economies in Latin America and Asia. These issues are especially important in the current economic situation of increasing global competition, where countries and companies need ideas about how to develop from low-cost producers to providers of more knowledge-intensive products and services.

The purpose of this collection is to develop a complex and systematic empirical view of innovation system development in small catching-up economies. To that end, the following research tasks were set:

- To establish a theoretical framework of the innovation system focusing on the specific characteristics of a small, path-dependent, latecomer economy and its learning processes.
- To explain the issue of innovation success and failure along with its causes and measurement problems.
- To investigate organizational innovation capabilities and internationalization at company level.
- To pinpoint the role of human capital development and social factors in the innovation process.
- To develop an integrated view of innovation policies in the context of a small catching-up economy along with policy suggestions and implications.

The book offers the first comprehensive view of innovation system development in the context of small catching-up economies. The smallness, path dependency, and latecomer status of such economies create some inherent limitations for their innovation systems, but these special characteristics can offer advantages as well.

Smallness is often related to increased flexibility and shorter reaction times, while latecomers can also benefit from earlier experiences and fine-tune certain arrangements accordingly. Path dependency highlights the fact that the innovation system development processes are considerably influenced by the past of a particular country or region.

By incorporating these three features into one complex analysis, this collection intends to provide a unique viewpoint of innovation systems, including aspects of learning, innovation success measurement, organizational innovation capabilities, internationalization, human and social capital in the innovation process, and policy implications. The book is predominantly an empirical contribution, except for first Part, which is somewhat more theoretical by nature, building the background. The primary research questions are as follows:

- What special features characterize the development of innovation systems in small catching-up economies?
- How is this development influenced by the path dependency phenomenon?

These two questions form the leading motivation for the analysis and discussion. Some chapters address one or both questions directly, while others relate to them more implicitly. Perhaps smallness is a slightly more prominent determinant than path dependency, but both help to establish a novel and relevant research framework for the analysis of innovation systems.

The following more detailed research questions are raised in order to pinpoint the major elements of the complex study in detail:

- What are the causes for innovation success/failure?
- How should we measure innovation performance?
- How do organizational capabilities and internationalization tendencies relate to company-level innovations?
- What is the role of human capital and social factors in the innovation process?
- How can various policies support innovation in an integrated manner?
- What are the policy suggestions and implications based on the analysis?

The answers to these questions should provide readers with a systemic view of the peculiarities of innovation system development in small catching-up economies. It should help provide an in-depth understanding of various determinants and their impacts on innovation processes. The policy implications offer a set of normative guidelines for enhancing innovation system development in the context of small catching-up economies.

The book has five larger parts. The first part establishes the theoretical background and research context. It explains the systemic view of innovation, outlines the specifics of small-scale innovation systems, discusses the nature of path dependency and latecomer status, reflects on characteristics of catching-up economies, and outlines the roles of creativity and learning in innovation processes. These more general topics lay the foundation for the following four parts that deal with various detailed elements of the innovation system.

Chapter 1 in the first part provides an overview of the systemic approach to innovation. The authors discuss the historical development of the approach as well as different types of innovation systems. In the second part of the chapter, they present theories influencing the innovation system approach and a critique of the approach. The first chapter concludes with a development of the system failure framework as a basis for public sector interventions.

Chapter 2 aims to outline the specific characteristics of small-scale national innovation systems. This discussion is predominantly based on a fragmented body of empirical works about various elements of innovation systems and policies. The chapter not only outlines several aspects common to small economies but also indicates that even small economies can be heterogeneous. Various development aspects, such as the role of foreign direct investment (FDI), knowledge, and networking are brought into focus along with policy considerations.

Chapter 3 examines the concepts of path dependency and latecomer countries within the framework of national innovation systems. It intends to identify major

lessons for Central and Eastern European countries in building up their national innovation systems based on the experience of Asian and Latin American countries. On the basis of this analysis, the authors draw several important conclusions and make relevant recommendations.

In Chapter 4, the authors seek to show the importance of the role of sectoral decomposition in knowledge creation across countries with different levels of development. They make use of microdata from the fourth European Community Innovation Survey (CIS 4) from 16 European countries, including data on 104,717 firms. As a result, the authors argue that innovation and knowledge creation varies mostly due to country-specific factors, and that industry-specific factors play a minor role.

Chapter 5 conceptualizes creativity and learning processes. The authors show the connections between creativity and innovation by offering a systematic discussion of individual and organizational-level determinants. These aspects include expertise, task motivation, and creative thinking skills as well as resources, managerial practices, and organizational culture.

The second part offers contributions dealing with the success and measurement of innovation. After discussing measurement, the analysis investigates the connection between innovation and productivity levels. The part concludes with two contributions about the various causes for innovation failure or success.

Chapter 6 deals with innovation measurement problems. This chapter bridges two approaches to assessing national innovation performance based on the composite indicators of the European Innovation Scoreboard (EIS) and the analysis of factors that may be behind these indicators. The chapter aims to explore what factors have been most influential in the innovation performance of different countries, and whether innovation measurement indicators capture these differences.

In Chapter 7, the authors investigate how the innovation–productivity relationship varies across subbranches of the service sector. For this analysis, they employ the CDM structural model of the innovation process, which consists of equations for innovation expenditures, innovation output, and productivity. The authors rely on panel data from three of the community innovation surveys for Estonia. The results show how product and process innovations are associated with the total factor productivity of firms in the service sector.

Chapter 8 analyzes a situation where a company from a small country with innovative technology attempts to invest in a larger emerging market country. It concludes that innovative partnerships supported by international financial institutions can make projects possible that otherwise would not materialize. These institutions need to provide more innovative risk mitigation instruments that are flexible and more cost effective for the private sector and with shorter processing time. The discussion in the chapter is based on a review of theoretical literature, secondary data, interviews, and the author's experience of working for the World Bank Group for 12 years on three continents.

Chapter 9 presents the notion that innovations are often associated with substantial risks, and failure is not rare. Thus, it is important to study what causes innovation

failure, how to reduce the risk of failure and increase the chance of innovation success. This analysis aims to investigate how the nature of network relationships and capabilities lead to innovation failure or success in Estonian firms. Based on survey results from 95 firms and evidence from 48 interviews, it concludes that the lack of sufficient capabilities and networks may indeed lead to innovation failure.

The third part includes empirical contributions dealing with innovation capabilities, where the first two contributions focus on organizational and process aspects. The following two studies discuss innovation capabilities in SMEs and the internationalization of innovations.

Chapter 10 sets out to present the patterns of transformation in the organizational culture of Estonian information and communication technology (ICT) organizations, and find connections between the culture of those organizations and their innovation activities. The authors do not focus on the question of “why,” but rather “how.” They analyze how the organizational culture of ICT companies has changed over the last two decades and discuss whether and how the transformation of their culture is reflected in their innovation activities.

Chapter 11 concerns cultural influences on innovation based on a comparative investigation of biotechnology companies. The chapter starts with a brief review of the literature on innovation and organizational culture and then focuses on cultural characteristics that have been associated with a firm’s capability to engage in successful innovation. In this study, interviews were conducted in 15 Estonian and 26 Danish biotechnology firms. Based on the findings, the authors identify several factors that might explain the difference in innovation capacity between these countries.

Chapter 12 provides the results of a study of the innovation capabilities of SMEs in Estonia, Latvia, and two catching-up regions in Poland and Germany. The authors distinguish between various capabilities, including a company’s basic assets and competencies. The chapter aims to identify the relationship between these capabilities and the company’s past and planned innovations and performance, and to also compare results across countries. In this analysis, they interviewed 245 top managers from SMEs involved in tourism and food production.

In Chapter 13, the authors analyze the relationship between inward and outward FDI at either company or industry level and the innovation behavior of companies in Estonia. They use company-level data from three waves of the Community Innovation Surveys combined with financial data from the Estonian Business Register and FDI data from Balance of Payments statistics. The authors use the propensity score matching method for their analysis.

The fourth part offers an analysis of human and social capital in the context of innovation. It also contributes to the discussion of the relationships between innovation and various transfers between markets (knowledge transfers, FDI, labor mobility).

The exploratory Chapter 14 investigates the relationship between innovative activities and human and social capital in the context of catching-up countries facing both latecomer advantages and path dependency. Data on 30 European countries

are analyzed, including ten transition countries with communist backgrounds that are considered catching-up countries in this study. Among other interesting results, authors show that catching-up economies, which tend to have poorer performance in innovative activities, also tend to have lower levels of human and social capital.

Chapter 15 aims to estimate how technological change affects demand for skills based on data from Estonia, a CEE country. The main research question is whether technological change has augmented skills in a midtransition country. The study seeks to uncover whether such demand has been magnified by trade activities or by FDI. In terms of trade activities, the author delves deep into details to see whether the effects of technological change on skills vary according to the level of technological development in the export destination.

Chapter 16 looks at the relationships between interfirm labor mobility and technological innovation at firm level. The authors use a novel Estonian database from an online job search portal that includes detailed data on occupations and education. The employee-level data is matched with Community Innovation Survey 2006 data covering 2004–2006 on business enterprises. The research team estimates various specifications of the knowledge production functions augmented using mobility indicators. The results indicate that product innovations and total factor productivity are associated with subsequent higher worker flows especially from innovative firms, whereas the flows of professionals and technicians are more important.

Finally, the fifth part is about policy. It deals with the role of the public sector in small innovation systems characterized by path dependency. The next study provides policy suggestions and the final discussion focuses on policy implications concerning education.

Chapter 17 analyzes the structure and role of public sector inputs on a country's innovativeness. It discusses the literature on the structure of public sector inputs and the role such inputs play in innovativeness, and offers an empirical analysis concerning the structure of public sector inputs for innovativeness and the impact on business sector innovation processes in EU Member States, Croatia, Turkey, Iceland, and Norway. The data are from the Eurostat database, and additional data originate from the European Innovation Scoreboard database. The authors conduct a component analysis to find the structure of public sector inputs for innovativeness. Thereafter, the influence of factors is assessed using multiple regression models to explain the public sector's role in formatting business sector innovation processes.

In Chapter 18, the authors discuss the public innovation conditions prevailing in and policy measures available to a small country such as Estonia, as well as the effectiveness of such measures. The suggestions include multiple strategies and measures, such as the instruments for promoting innovation among private Estonian companies, demand-side instruments (e.g., public procurement), sales of public property, and participation in ownership to assist innovative firms. Private and public innovations concern the innovative activities of public companies, while other targeted strategies should deal with public research and the supply of infrastructure services. Public sector-oriented innovation also refers to strategies concerning education and infrastructure as well as legislation and public management.

Chapter 19 proposes policy implications for improving the education sector's innovation in schools through introducing ideas for leadership advancement, and shaping organizational culture and performance management principles. School performance is viewed in terms of creating citizens for society – individuals who are active, capable of developing, thinking, and learning. Schools need to create the fundamentals for the successful subsistence of their pupils in society and sustainable input for universities and the labor market.

The variety of studies and discussions in this book should provide readers with a unique multidimensional understanding of innovation systems in small path-dependent economies that, in the European and global context, have some catching-up to do.

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